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Intervals and Inversions

The distance between two pitches is the interval between them. The name of an interval depends both on how the notes are written and the actual distance between the notes as measured in half steps.

The Distance Between Pitches

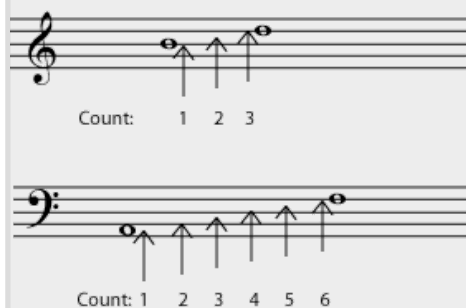
The **interval** between two notes is the distance between the two [pitches](#) - in other words, how much higher or lower one note is than the other. This concept is so important that it is almost impossible to talk about [scales](#), [chords](#), [harmonic progression](#), [cadence](#), or [dissonance](#) without referring to intervals. So if you want to learn music theory, it would be a good idea to spend some time getting comfortable with the concepts below and practicing identifying intervals.

Scientists usually describe the distance between two pitches in terms of the difference between their [frequencies](#). Musicians find it more useful to talk about interval. Intervals can be described using [half steps and whole steps](#). For example, you can say "B natural is a half step below C natural", or "E flat is a step and a half above C natural". But when we talk about larger intervals in the [major/minor system](#), there is a more convenient and descriptive way to name them.

Naming Intervals

The first step in naming the interval is to find the distance between the notes **as they are written on the staff**. Count every line and every space in between the notes, as well as the lines or spaces that the notes are on. This gives you the number for the interval.

Example: Counting Intervals



To find the interval, count the lines or spaces that the two notes are on as well as all the lines or spaces in between. The interval between B and D is a third. The interval between A and F is a sixth. Note that, at this stage, [key signature](#), [clef](#), and [accidentals](#) do not matter at all.

The **simple intervals** are one octave or smaller.

Simple Intervals



If you like you can listen to each interval as written in [\[link\]: prime, second, third, fourth](#), [\[missing_resource: fifth.mid\]](#)[sixth, seventh](#), [\[missing_resource: octave.mid\]](#)

Compound intervals are larger than an octave.

Compound Intervals



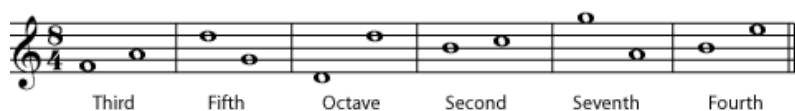
Listen to the compound intervals in [\[link\]: ninth, tenth, eleventh](#).

Exercise:

Problem: Name the intervals.



Solution:



Exercise:

Problem: Write a note that will give the named interval.



Solution:



Classifying Intervals

So far, the actual distance, in half-steps, between the two notes has not mattered. But a third made up of three half-steps sounds different from a third made up of four half-steps. And a fifth made up of seven half-steps sounds very different from one of only six half-steps. So in the second step of identifying an interval, [clef](#), [key signature](#), and [accidentals](#) become important.



A to C natural and A to C sharp are both thirds, but A to C sharp is a larger interval, with a different sound.

The difference between the intervals A to E natural and A to E flat is even more noticeable.

Listen to the differences in the [thirds](#) and the [fifths](#) in [\[link\]](#).

So the second step to naming an interval is to classify it based on the number of [half steps](#) in the interval. Familiarity with the [chromatic scale](#) is necessary to do this accurately.

Perfect Intervals

Primes, octaves, fourths, and fifths can be **perfect** intervals.

Note: These intervals **are never classified as major or minor**, although they can be augmented or diminished (see [below](#)).

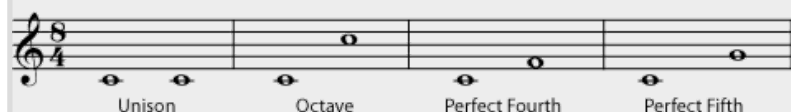
What makes these particular intervals perfect? The physics of sound waves (**acoustics**) shows us that the notes of a perfect interval are very closely related to each other. (For more

information on this, see [Frequency, Wavelength, and Pitch](#) and [Harmonic Series](#).) Because they are so closely related, they sound particularly good together, a fact that has been noticed since at least the times of classical Greece, and probably even longer. (Both the octave and the perfect fifth have prominent positions in most of the world's musical traditions.) Because they sound so closely related to each other, they have been given the name "perfect" intervals.

Note: Actually, modern [equal temperament](#) tuning does not give the harmonic-series-based [pure](#) perfect fourths and fifths. For the music-theory purpose of identifying intervals, this does not matter. To learn more about how tuning affects intervals as they are actually played, see [Tuning Systems](#).

A perfect prime is also called a **unison**. It is two notes that are the same [pitch](#). A perfect octave is the "same" note an [octave](#) - 12 half-steps - higher or lower. A **perfect 5th** is 7 half-steps. A **perfect fourth** is 5 half-steps.

**Example:
Perfect Intervals**



Listen to the [octave](#), [perfect fourth](#), and [perfect fifth](#).

Major and Minor Intervals

Seconds, thirds, sixths, and sevenths can be **major intervals** or **minor intervals**. The minor interval is always a half-step smaller than the major interval.

Major and Minor Intervals

- 1 half-step = minor second (m2)
- 2 half-steps = major second (M2)
- 3 half-steps = minor third (m3)
- 4 half-steps = major third (M3)
- 8 half-steps = minor sixth (m6)
- 9 half-steps = major sixth (M6)
- 10 half-steps = minor seventh (m7)
- 11 half-steps = major seventh (M7)

Example:
Major and Minor Intervals

Two staves of music in 8/4 time, G-clef. The first staff shows intervals from G4 to A4: Minor Second (G4 to A-flat4), Major Second (G4 to A4), Minor Third (G4 to B-flat4), and Major Third (G4 to B4). The second staff shows intervals from G4 to A5: Minor Sixth (G4 to F4), Major Sixth (G4 to F#4), Minor Seventh (G4 to G-flat5), and Major Seventh (G4 to G5).

Listen to the [minor second](#), [major second](#), [minor third](#), [major third](#), [minor sixth](#), [major sixth](#), [minor seventh](#), and [major seventh](#).

Exercise:

Problem: Give the complete name for each interval.

Three staves of music in 8/4 time. The first two staves are in G-clef (treble clef) and the third is in F-clef (bass clef). Each staff contains four intervals: 1. G4 to A4, 2. G4 to B-flat4, 3. G4 to B4, 4. G4 to A5.

Solution:

Three staves of music in 8/4 time, identical to the exercise. The intervals are labeled below each staff: Staff 1: Major Second, Minor Third, Perfect Fifth, Perfect Fourth. Staff 2: Perfect Octave, Minor Sixth, Unison (Perfect prime), Major Seventh. Staff 3: Major Sixth, Minor Seventh, Major Third, Minor Second.

Exercise:

Problem: Fill in the second note of the interval given.

P5 higher P4 lower m2 lower Pprime

M3 higher m7 lower P 8ve higher M6 higher

m6 lower M2 higher P5 lower m3 higher

Solution:

P5 higher P4 lower m2 lower Pprime

M3 higher m7 lower P 8ve higher M6 higher

m6 lower M2 higher P5 lower m3 higher

Augmented and Diminished Intervals

If an interval is a half-step larger than a perfect or a major interval, it is called **augmented**. An interval that is a half-step smaller than a perfect or a minor interval is called **diminished**. A [double sharp](#) or [double flat](#) is sometimes needed to write an augmented or diminished interval correctly. Always remember, though, that it is the actual distance in half steps between the notes that determines the type of interval, not whether the notes are written as natural, sharp, or double-sharp.

Example:
Some Diminished and Augmented Intervals

Augmented Prime Diminished Second Augmented Third Diminished Sixth

Augmented Seventh Diminished Octave Augmented Fourth Diminished Fifth

Listen to the [augmented prime](#), [diminished second](#), [augmented third](#), [diminished sixth](#), [augmented seventh](#), [diminished octave](#), [augmented fourth](#), and [diminished fifth](#). Are you surprised that the augmented fourth and diminished fifth sound the same?

Exercise:

Problem: Write a note that will give the named interval.

Augmented Octave Higher Diminished Sixth Lower Augmented Fourth Higher Diminished Second Lower

Augmented Prime Higher Diminished Seventh Lower Augmented Third Higher Diminished Fifth Lower

Solution:

Augmented Octave Higher Diminished Sixth Lower Augmented Fourth Higher Diminished Second Lower

Augmented Prime Higher Diminished Seventh Lower Augmented Third Higher Diminished Fifth Lower

As mentioned above, the diminished fifth and augmented fourth sound the same. Both are six half-steps, or **three whole tones**, so another term for this interval is a **tritone**. In [Western Music](#), this unique interval, which cannot be spelled as a major, minor, or perfect interval, is considered unusually [dissonant](#) and unstable (tending to want to [resolve](#) to another interval).

You have probably noticed by now that the tritone is not the only interval that can be "spelled" in more than one way. In fact, because of [enharmonic spellings](#), the interval for any two pitches can be written in various ways. A major third could be written as a

diminished fourth, for example, or a minor second as an augmented prime. **Always classify the interval as it is written; the composer had a reason for writing it that way.** That reason sometimes has to do with subtle differences in the way different written notes will be interpreted by performers, but it is mostly a matter of placing the notes correctly in the context of the [key](#), the [chord](#), and the evolving [harmony](#). (Please see [Beginning Harmonic Analysis](#) for more on that subject.)

Enharmonic Intervals



Any interval can be written in a variety of ways using [enharmonic](#) spelling. Always classify the interval as it is written.

Inverting Intervals

To **invert** any interval, simply imagine that one of the notes has moved one octave, so that the higher note has become the lower and vice-versa. Because inverting an interval only involves moving one note by an octave (it is still essentially the "same" note in the tonal system), intervals that are **inversions** of each other have a very close relationship in the [tonal](#) system.

Inverting Intervals



To find the inversion of an interval

1. To name the new interval, subtract the name of the old interval from 9.
2. The inversion of a perfect interval is still perfect.
3. The inversion of a major interval is minor, and of a minor interval is major.
4. The inversion of an augmented interval is diminished and of a diminished interval is augmented.

Example:

Minor Seventh

$9 - 7 = 2$

Minor inverts to major

Inversion is a Major Second

Exercise:

Problem: What are the inversions of the following intervals?

1. Augmented third
2. Perfect fifth
3. Diminished fifth
4. Major seventh
5. Minor sixth

Solution:

1. Diminished sixth
2. Perfect fourth
3. Augmented fourth
4. Minor second
5. Major third

Summary

Here is a quick summary of the above information, for reference.

Number of half steps	Common Spelling	Example, from C	Alternate Spelling	Example, from C	Inversion
0	Perfect Unison (P1)	C	Diminished Second	D double flat	Octave (P8)

1	Minor Second (m2)	D flat	Augmented Unison	C sharp	Major Seventh (M7)
2	Major Second (M2)	D	Diminished Third	E double flat	Minor Seventh (m7)
3	Minor Third (m3)	E flat	Augmented Second	D sharp	Major Sixth (M6)
4	Major Third (M3)	E	Diminished Fourth	F flat	Minor Sixth (m6)
5	Perfect Fourth (P4)	F	Augmented Third	E sharp	Perfect Fifth (P5)
6	Tritone (TT)	F sharp or G flat	Augmented Fourth or Diminished Fifth	F sharp or G flat	Tritone (TT)
7	Perfect Fifth (P5)	G	Diminished Sixth	A double flat	Perfect Fourth (P4)
8	Minor Sixth (m6)	A flat	Augmented Fifth	G sharp	Major Third (M3)
9	Major Sixth (M6)	A	Diminished Seventh	B double flat	Minor Third (m3)
10	Minor Seventh (m7)	B flat	Augmented Sixth	A sharp	Major Second (M2)
11	Major Seventh (M7)	B	Diminished Octave	C' flat	Minor Second (m2)

12	Perfect Octave (P8)	C'	Augmented Seventh	B sharp	Perfect Unison (P1)
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The examples given name the note reached if one starts on C, and goes up the named interval.

Summary Notes: Perfect Intervals

- A perfect prime is often called a unison. It is two notes of the same pitch.
- A perfect octave is often simply called an octave. It is the next "note with the same name".
- Perfect intervals - unison, fourth, fifth, and octave - are never called major or minor

Summary Notes: Augmented and Diminished Intervals

- An augmented interval is one half step larger than the perfect or major interval.
- A diminished interval is one half step smaller than the perfect or minor interval.

Summary Notes: Inversions of Intervals

- To find the inversion's number name, subtract the interval number name from 9.
- Inversions of perfect intervals are perfect.
- Inversions of major intervals are minor, and inversions of minor intervals are major.
- Inversions of augmented intervals are diminished, and inversions of diminished intervals are augmented.

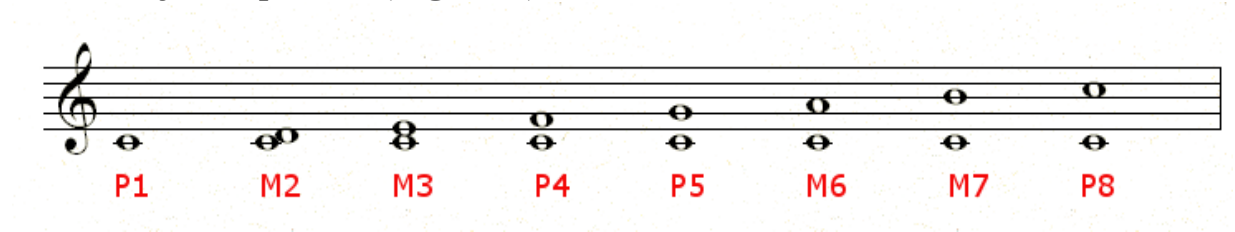
Quickly Recognizing Simple Intervals

Methods to rapidly recognize simple intervals in music.

Musicians need to be able to quickly recognize intervals in printed music. Counting intervals by half steps is often too slow, particularly with intervals greater than thirds. This module introduces a method that can greatly increase facility with interval recognition.

(This module assumes that you understand how to assign interval numbers and quality. Please see “Interval” by Katherine Schmidt-Jones, module [m10867](#), for further reference)

A thorough knowledge of major scales is central to rapid identification of intervals. The quality of the interval between each scale step and the tonic is either major or perfect (Figure 1)



In particular, intervals up to a perfect 5th can be quickly recognized through knowledge of the major scales. Scale steps are used as quick reference points with which to compare the intervals. Let's look at some examples to explain how this works.

In Figure 2, consider the lowest pitch the tonic note of B major. Knowing that B major has a C# in the scale indicates to us that C natural is not a major 2nd above B. Since C is a half step below C# the interval is therefore a minor 2nd.



In Figure 3, a D major scale has two sharps, one of which is F#. Since F natural is half a step below F# it must be a minor third above D.



In Figure 4, A major has F#, C#, and G# but no D#. D natural is a perfect 4th above A; therefore D# must be an augmented 4th above A.



In Figure 5, F major has one flat-Bb. Bb is therefore a perfect fourth above F.

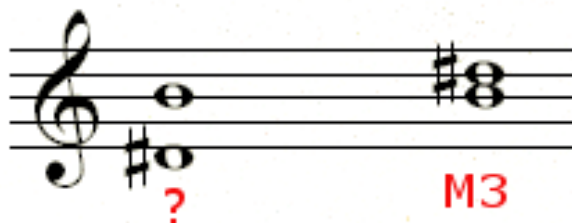


In Figure 6, a B major scale requires an F#. F natural, being half a step lower, is a diminished fifth above B.



Other “Tricks”

I find classifying intervals of sixths or sevenths more problematic with scales. I often double check my answers by inverting the intervals. For instance in Figure 7, it is not easy for me to quickly recognize the interval D# to B, but B to D# can be quickly recognized. Rules of inversion indicate that a major 3rd inverts to a minor 6th.



Likewise the seventh in Figure 8 is easier to recognize as a second:

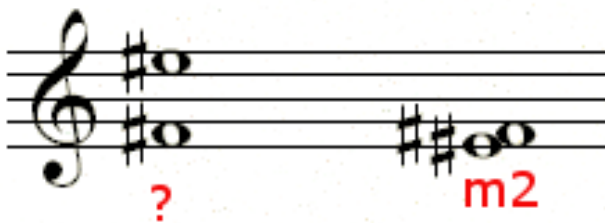


Figure 8 illustrates a further “trick.” Since both notes are preceded by sharps, one can ignore the sharps and consider the interval to be the same as E to F. This is easier to recognize E to F as a minor second than E# to F#. One may do the same operation if both notes bear flats; consider the interval without the flats present.

Consonance and Dissonance

Consonance and dissonance are musical terms describing whether combinations of notes sound good together or not.

Notes that sound good together when played at the same time are called **consonant**. Chords built only of consonances sound pleasant and "stable"; you can listen to one for a long time without feeling that the music needs to change to a different chord. Notes that are **dissonant** can sound harsh or unpleasant when played at the same time. Or they may simply feel "unstable"; if you hear a chord with a dissonance in it, you may feel that the music is pulling you towards the chord that **resolves** the dissonance. Obviously, what seems pleasant or unpleasant is partly a matter of opinion. This discussion only covers consonance and dissonance in [Western](#) music.

Note: For activities that introduce these concepts to young students, please see [Consonance and Dissonance Activities](#).

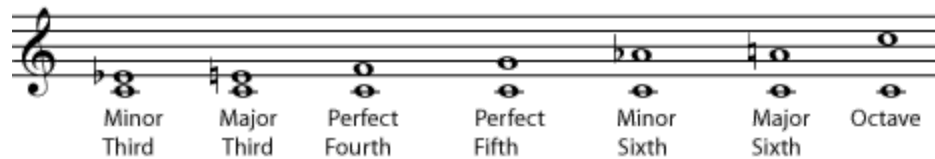
Of course, if there are problems with tuning, the notes will not sound good together, but this is not what consonance and dissonance are about. (Please note, though, that the choice of tuning system can greatly affect which intervals sound consonant and which sound dissonant! Please see [Tuning Systems](#) for more about this.)

Consonance and dissonance refer to [intervals](#) and [chords](#). The **interval** between two notes is the number of [half steps](#) between them, and all intervals have a name that musicians commonly use, like [major third](#) (which is 4 half steps), [perfect fifth](#) (7 half steps), or [octave](#). (See [Interval](#) to learn how to determine and name the interval between any two notes.)

An interval is measured between two notes. When there are more than two notes sounding at the same time, that's a **chord**. (See [Triads](#), [Naming Triads](#), and [Beyond Triads](#) for some basics on chords.) Of course, you can still talk about the interval between any two of the notes in a chord.

The [simple intervals](#) that are considered to be consonant are the [minor third](#), [major third](#), [perfect fourth](#), [minor sixth](#), [major sixth](#), and the [octave](#)

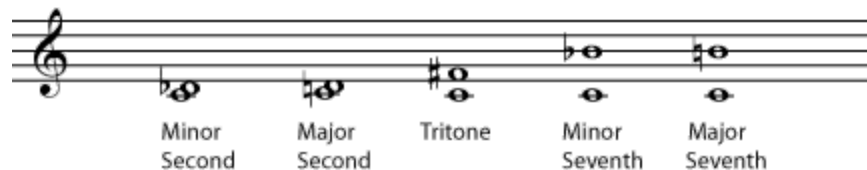
Consonant Intervals



In modern [Western Music](#), all of these intervals are considered to be pleasing to the ear. Chords that contain only these intervals are considered to be "stable", restful chords that don't need to be [resolved](#). When we hear them, we don't feel a need for them to go to other chords.

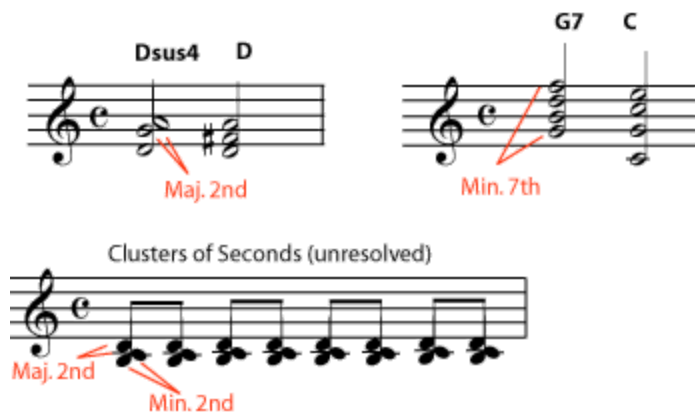
The intervals that are considered to be dissonant are the [minor second](#), the [major second](#), the [minor seventh](#), the [major seventh](#), and particularly the [tritone](#), which is the interval in between the perfect fourth and perfect fifth.

Dissonant Intervals



These intervals are all considered to be somewhat unpleasant or tension-producing. In [tonal music](#), chords containing dissonances are considered "unstable"; when we hear them, we expect them to move on to a more stable chord. Moving from a dissonance to the consonance that is expected to follow it is called **resolution**, or **resolving** the dissonance. The pattern of tension and release created by resolved dissonances is part of what makes a piece of music exciting and interesting. Music that contains no dissonances can tend to seem simplistic or boring. On the other hand, music that contains a lot of dissonances that are never resolved (for example, much of twentieth-century "classical" or "art" music) can be difficult for some people to listen to, because of the unreleased tension.

Resolving Dissonances



In most music a dissonance will resolve; it will be followed by a consonant chord that it naturally leads to, for example a [G seventh chord resolves to a C major chord](#), and a [D suspended fourth resolves to a D major chord](#). A series of [unresolved dissonances](#), on the other hand, can produce a sense of unresolved tension.

Why are some note combinations consonant and some dissonant? Preferences for certain sounds is partly cultural; that's one of the reasons why the traditional musics of various cultures can sound so different from each other. Even within the tradition of [Western music](#), opinions about what is unpleasantly dissonant have changed a great deal over the centuries. But consonance and dissonance do also have a strong physical basis in nature.

In simplest terms, the sound waves of consonant notes "fit" together much better than the sound waves of dissonant notes. For example, if two notes are an octave apart, there will be exactly two waves of one note for every one wave of the other note. If there are two and a tenth waves or eleven twelfths of a wave of one note for every wave of another note, they don't fit together as well. For much more about the physical basis of consonance and

dissonance, see [Acoustics for Music Theory](#), [Harmonic Series](#), and [Tuning Systems](#).